

# **Operational Plan: Sockeye Salmon Escapement Studies at the Russian River**

by

**Jason A. Pawluk**

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May 2015

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



## Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics		
centimeter	cm	Alaska Administrative Code	AAC	all standard mathematical signs, symbols and abbreviations		
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H <sub>A</sub>	
gram	g	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	<i>e</i>	
hectare	ha			catch per unit effort	CPUE	
kilogram	kg			coefficient of variation	CV	
kilometer	km	at	@	common test statistics	(F, t, $\chi^2$ , etc.)	
liter	L			confidence interval	CI	
meter	m			correlation coefficient		
milliliter	mL	compass directions:		(multiple)	R	
millimeter	mm	east	E	correlation coefficient (simple)	r	
Weights and measures (English)		north	N	covariance	cov	
	cubic feet per second	ft³/s	south	S	degree (angular )	°
	foot	ft	west	W	degrees of freedom	df
	gallon	gal	copyright	©	expected value	<i>E</i>
	inch	in	corporate suffixes:		greater than	>
	mile	mi	Company	Co.	greater than or equal to	≥
	nautical mile	nmi	Corporation	Corp.	harvest per unit effort	HPUE
	ounce	oz	Incorporated	Inc.	less than	<
	pound	lb	Limited	Ltd.	less than or equal to	≤
	quart	qt	District of Columbia	D.C.	logarithm (natural)	ln
yard	yd	et alii (and others)	et al.	logarithm (base 10)	log	
Time and temperature		et cetera (and so forth)	etc.	logarithm (specify base)	log <sub>2</sub> , etc.	
		exempli gratia		minute (angular)	'	
	day	d	(for example)	e.g.	not significant	NS
	degrees Celsius	°C	Federal Information Code	FIC	null hypothesis	H <sub>0</sub>
	degrees Fahrenheit	°F	id est (that is)	i.e.	percent	%
	degrees kelvin	K	latitude or longitude	lat or long	probability	P
	hour	h	monetary symbols		probability of a type I error	
	minute	min	(U.S.)	\$, ¢	(rejection of the null hypothesis when true)	$\alpha$
	second	s	months (tables and figures): first three letters	Jan,...,Dec	probability of a type II error	
	Physics and chemistry		registered trademark	®	(acceptance of the null hypothesis when false)	$\beta$
all atomic symbols			trademark	™	second (angular)	"
alternating current		AC	United States		standard deviation	SD
ampere		A	(adjective)	U.S.	standard error	SE
calorie		cal	United States of America (noun)	USA	variance	
direct current		DC	U.S.C.	United States Code	population sample	Var var
hertz		Hz	U.S. state	use two-letter abbreviations (e.g., AK, WA)		
horsepower		hp				
hydrogen ion activity (negative log of)		pH				
parts per million		ppm				
parts per thousand	ppt, ‰					
volts	V					
watts	W					

***REGIONAL OPERATIONAL PLAN SF.2A.2015.09***

**SOCKEYE SALMON ESCAPEMENT STUDIES AT THE RUSSIAN RIVER**

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May 2015

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## SIGNATURE PAGE

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Project leader (s): Jason Pawluk

Division, Region and Area: Division of Sport Fish, Region II, Soldotna

Project Nomenclature:

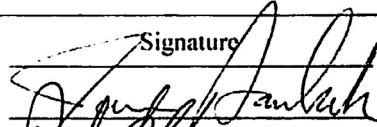
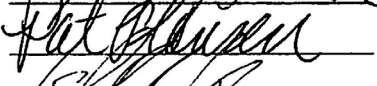

Period Covered: January 2015 through December 2018

Field Dates: June 1 through September 10

Plan Type: Category II

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### Approval

Title	Name	Signature	Date
Project leader	Jason Pawluk		4/30/15
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## ABSTRACT

Russian River escapement data has been collected since 1962 and is one of the oldest stock assessment projects in the state of Alaska. During 2015–2019, the Russian River weir will be operated annually from early June through the first week of September. All species of fish seen passing the weir through the fish chute will be enumerated daily. Sampling of sockeye salmon for age, sex, and length data will be done each Friday and the sample size each week will be based on the previous week's fish passage. Sockeye and Chinook salmon spawning downstream of the Russian River weir to the confluence of the Russian River and the Kenai River will be assessed by a foot survey during the fourth week of August. Multiple foot surveys will also be conducted from mid-May to 10 June to assess spawning rainbow trout.

Key words: Russian River, sockeye salmon, Chinook salmon, weir, age, sex, and length composition, foot surveys, rainbow trout, spawning surveys.

## PURPOSE

This project will continue gathering biological and fishery data obtained from operation of the weir for the historical database of the salmon resources of the Russian River. This database benefits sockeye and Chinook salmon resources by providing information for sound biological management and benefits the angling public by providing for a maximum sustained harvest of sockeye salmon by developing appropriate levels of escapement and determining if escapement goals (EG) are achieved annually (early-run EG range is 22,000–42,000, late-run EG range is 30,000–110,000 fish).

## BACKGROUND

The Russian River (Figure 1) supports one of the largest sport fisheries for sockeye salmon (*Oncorhynchus nerka*) in Alaska. Mean effort for recreational anglers during 2004–2013 averaged 55,308 angler-days based on Statewide Harvest Survey estimates for all species (Jennings et al. 2004, 2006a-b, 2007, 2009a-b, 2010a-b, and 2011a-b, 2015, Jennings personal communication). Mean annual sport harvest of sockeye salmon during this period exceeded 55,000 fish (Table 1). There are 5 main access locations to the Russian River fishery; these include the ferry access at the confluence and 4 river access trails, which connect the USFS Russian River Campground with the Russian River (Figure 2).

Russian River sockeye salmon run exhibits a bimodal entry pattern with the modes referred to as the early and late runs. Escapement goal (EG) ranges are established for both the early and late runs (early-run biological EG = 22,000–42,000 and late-run sustainable EG = 30,000–110,000 fish). The population dynamics of the late run are not well understood. Early-run sockeye salmon in the Kenai River drainage are almost exclusively of Russian River origin, are harvested primarily in the Russian River area sport fishery, and are easily assessed at the Russian River weir. The late run, however, is comprised of stocks returning to numerous locations throughout the Kenai River drainage and are harvested in the Upper Cook Inlet commercial fisheries, the Cook Inlet personal use fishery, the Kenaitze educational fishery, the mainstem Kenai River sport fishery, and the Russian River area sport fishery. A small subsistence harvest also occurs from the waters of the Kenai River adjacent to federal lands.

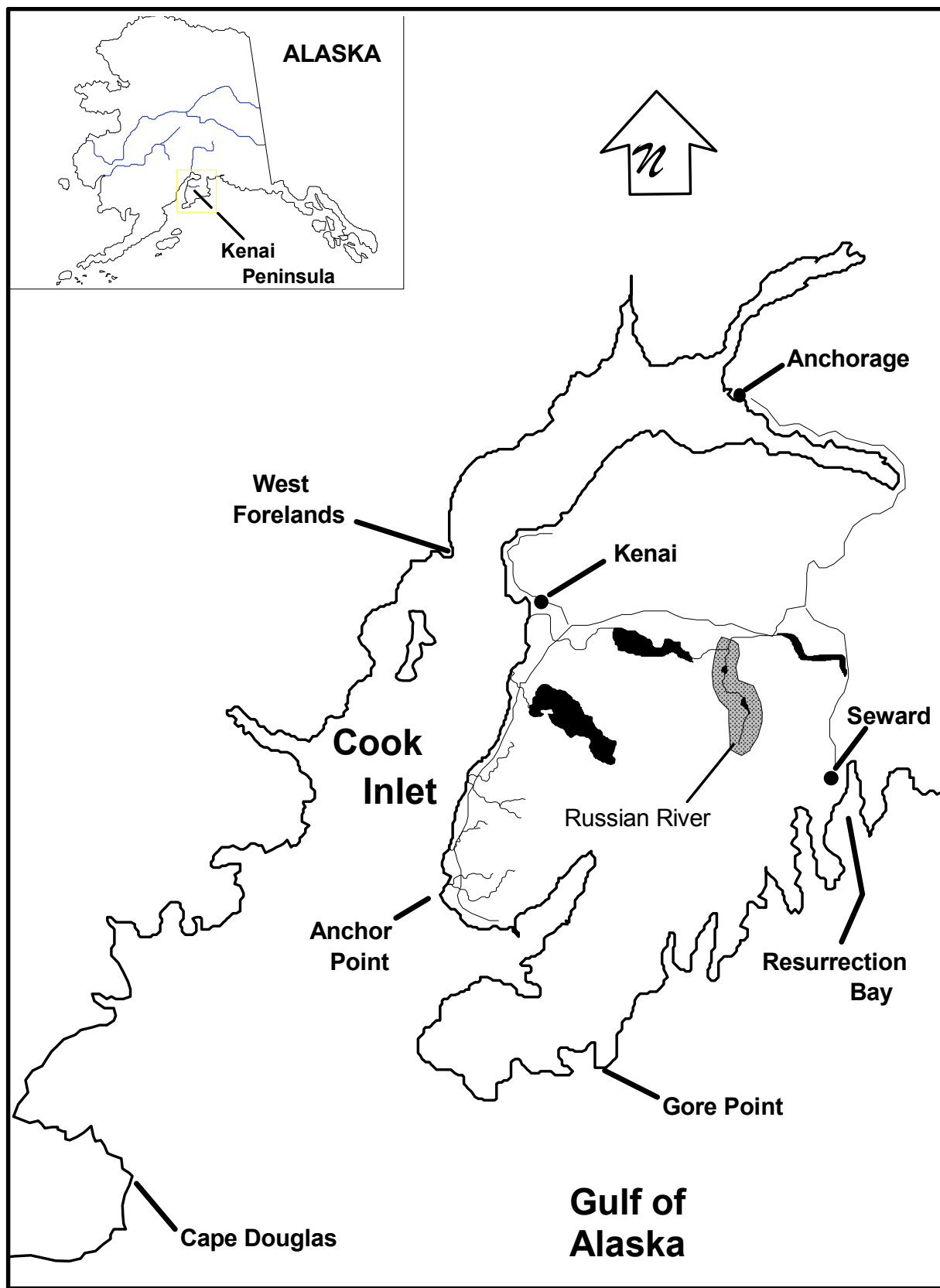


Figure 1.—Location of the Russian River.

Table 1.—Early (ER) and late run (LR) Russian River sockeye salmon angler effort, harvest, spawning escapement, local run, and spawners below the weir, 1979–2014.

Year	Effort <sup>a</sup>	Sport harvest <sup>b</sup>		Subsistence harvest <sup>c</sup>		Spawning escapement <sup>d</sup>		Local run <sup>e</sup>	
		ER	LR	ER	LR	ER	LR	ER	LR
1979 <sup>f</sup>	55,000	8,400	26,840	ND	ND	19,577	88,007	27,977	114,847
1980	56,330	27,220	33,500	ND	ND	28,045	84,555	55,265	118,055
1981	51,030	10,720	23,720	ND	ND	20,499	45,166	31,219	68,886
1982	51,480	34,500	10,320	ND	ND	55,022	31,822	89,522	42,142
1983	31,860	8,360	16,000	ND	ND	20,718	34,284	29,078	50,284
1984	49,550	35,880	21,970	ND	ND	28,767	92,791	64,647	114,761
1985	50,770	12,300	58,410	ND	ND	28,893	138,377	41,193	196,787
1986	52,250	35,100	30,810	ND	ND	34,749	41,868	69,849	72,678
1987	113,010	154,200	40,580	ND	ND	58,019	57,426	212,219	98,006
1988	72,030	54,780	19,540	ND	ND	50,020	42,850	104,800	62,390
1989	60,570	11,290	55,210	ND	ND	15,017	138,532	26,628	193,742
1990	84,710	30,215	56,180	ND	ND	25,575	84,575	56,931	140,755
1991	85,741	65,390	31,450	ND	ND	30,316	79,982	97,779	111,432
1992	60,499	30,512	26,101	ND	ND	36,330	63,091	66,842	89,192
1993	58,093	37,261	26,772	ND	ND	38,735	100,381	75,996	127,153
1994	64,134	48,923	26,375	ND	ND	39,678	125,821	88,601	152,196
1995	48,185	23,572	11,986	ND	ND	27,883	62,502	51,455	74,488
1996	50,122	39,075	19,136	ND	ND	52,255	35,263	91,330	54,399
1997	46,914	36,788	12,910	ND	ND	33,742	67,474	70,530	80,384
1998	47,942	42,711	25,110	ND	ND	33,852	113,353	76,563	138,463
1999	64,536	34,283	32,335	ND	ND	33,916	142,164	68,199	174,499
2000	69,864	40,732	30,229	ND	ND	31,300	57,813	72,032	88,042
2001	55,972	35,400	18,550	ND	ND	77,576	75,478	112,976	94,028
2002	68,263	52,139	31,999	ND	ND	85,943	62,115	138,082	94,114
2003	50,448	22,986	28,085	ND	ND	23,650	157,469	46,636	185,554

-continued-

Table 1.–Part 2 of 2.

Year	Effort <sup>a</sup>	Sport harvest <sup>b</sup>		Subsistence harvest <sup>c</sup>		Spawning escapement <sup>d</sup>		Local run <sup>e</sup>	
		ER	LR	ER	LR	ER	LR	ER	LR
2004	60,784	32,727	22,417	ND	ND	56,582	110,244	89,309	132,661
2005	55,801	37,139	18,503	ND	ND	52,903	59,473	90,042	77,976
2006	70,804	51,167	29,694	ND	ND	80,524	89,160	131,691	118,854
2007	57,755	36,805	16,863	380	298	27,298	52,949	64,483	70,110
2008	55,444	42,492	23,680	928	478	30,989	46,635	74,409	70,793
2009	64,518	59,097	33,935	543	431	52,178	80,088	111,818	114,454
2010	39,873	23,412	9,333	615	246	27,074	38,848	51,101	48,427
2011	47,264	22,697	14,412	642	347	29,129	41,529	52,468	56,288
2012	41,152	15,231	15,074	867	461	24,115	54,911	40,213	70,446
2013	59,682	27,162	20,146	768	567	35,776	31,573	63,706	52,286
2014	n/a	n/a	n/a	n/a	n/a	44,920	52,277	44,920	52,277
Average									
1960–2013 <sup>g</sup>	58,639	36,590	26,234	678	404	38,655	74,468	74,459	100,051
2004–2013	55,308	34,793	20,406	678	404	41,953	59,790	74,015	78,597

Source: Mills 1979-1994, Howe et al. 1995, 1996, 2001a-d, Walker et al. 2003; Jennings et al. 2004, 2006a-b, 2007, 2009a-b, 2010a-b, 2011a-b, 2015; Romberg et al. In prep; Pappas and Marsh 2004; Subsistence data, USFWS.

Note: ND = no data collected., n/a = data not yet available.

<sup>a</sup> Effort is angler days of effort in the fishery. 1979-1996 estimated from an inseason creel survey and only measures effort primarily for sockeye from 11 June to 20 August. 1996–2013 estimated from the SWHS and includes effort for the whole year and for other species.

<sup>b</sup> Harvest from 1979 to 1995 estimated from an inseason creel survey. No early- or late-run breakdown available from SWHS prior to 1996. Harvest from 1996 to 2013 estimated from the annual SWHS.

<sup>c</sup> Subsistence fishery started in 2007.

<sup>d</sup> Escapements for the early run are the number of fish counted passing the weir from its installation in June through 14 July. Escapements for the late run are the number of fish counted passing the weir from 15 July through when the weir is shut off after reaching 3 days of 1% of fish passage prior to 10 September, or whichever is later.

<sup>e</sup> Escapement above weir plus harvest; 1989–1991 includes 60 fish (in 1989) used to test brood source for disease, 1,572 fish (in 1990) and 729 fish (in 1991) used as brood source for stocking in Resurrection Bay.

<sup>f</sup> First year of operation of fish pass near Barrier Falls.

<sup>g</sup> For data prior to 1979 see Begich et al. (2013).

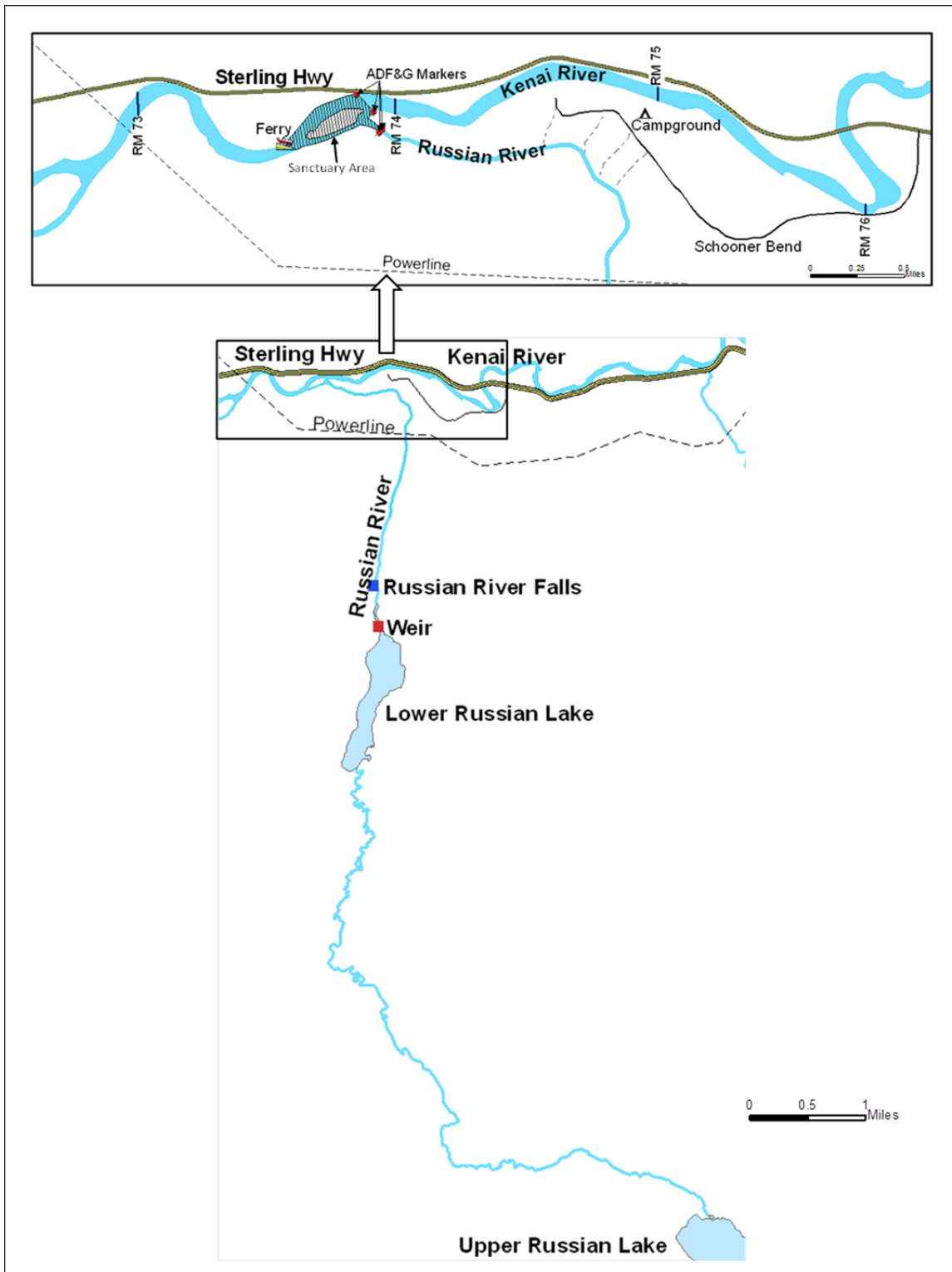


Figure 2.—Map of the Russian River sockeye salmon recreational fishing areas and fishing access locations.

Despite restrictions on the sport fishery, recreational demands upon the Russian River sockeye salmon resource have occasionally been greater than the stocks could sustain. The Division of Sport Fish has closed all or part of the fishery on 27 occasions since 1969 to achieve escapement goals. The most recent fishery restriction was in 2010. In subsequent years, the fishery has been liberalized by opening the sanctuary area prior to 15 July and by liberalizing the daily bag limit from 3 per day, 6 in possession to 6 per day, 12 in possession from the Russian Fly Fishing Only area downstream to Skilak Lake. These numerous EOs to the sockeye salmon fishery in the Russian River make it one of the most actively managed sport fisheries in Alaska.

This research program was first initiated on the Russian River in 1963 and provides information necessary for inseason management and refinement of management objectives. A weir located at the outlet of Lower Russian Lake is used to enumerate the spawning escapement as well as provide a means to trap fish and collect age, sex, and length information. Since 1997, estimates of harvest have been obtained exclusively from the Division of Sport Fish mail survey with estimates available in the fall of the following year (Table 1). Estimates of sport harvest, inriver run, and the age-sex composition of each run provide information to evaluate spawner-return relationships. These data are necessary to estimate appropriate levels of spawning escapement.

This operational plan covers 4 years: 2015, 2016, 2017, and 2018. The Objectives, Study Design, Data Collection, Data Reduction and Data Analysis will be the same for each of the 4 years.

## **OBJECTIVES**

- 1) Census the escapements of early-run and late-run sockeye salmon past the Russian River weir.
- 2) Estimate the age, sex, and age-by-sex compositions of early-run and late-run sockeye salmon spawning upstream of the Russian River weir such that the estimates for each run are within 10 percentage points of the actual values 95% of the time.
- 3) Index the escapement of late-run sockeye salmon spawning between the weir and Russian River Falls and that area downstream of the Russian River Falls extending to the Russian River and Kenai River confluence based on foot survey data collected during the peak spawning period.

## **TASKS**

- 1) Record the number of fish observed for each species passed upstream of the weir.
- 2) Index the number of Chinook salmon (*Oncorhynchus tshawytscha*) spawning between the weir and Russian River Falls extending downstream of the Russian River Falls to the Russian River and Kenai River confluence based on foot survey data collected during the peak spawning period.
- 3) Index the number of spawning rainbow trout from 100 yards above the powerline crossing on the Russian River downstream to the Russian River and Kenai River confluence based on foot survey data collected during the peak spawning period.

## METHODS

### WEIR PROCEDURES

A weir at the outlet of Lower Russian Lake will be used to census the spawning escapements of sockeye salmon and count other salmon (coho and Chinook salmon) and nongame species that utilize the upper reaches of the drainage. Due to water clarity and low water depth in the Russian River, salmonid species are easily differentiated by the weir attendants. Biological samples (age, sex, and mid eye to tail fork length) of sockeye salmon will be collected at the weir. In addition, weir personnel will collect climatological and river discharge data, operate the Russian River fish pass when necessary, and visually count late-run sockeye salmon that spawn downstream from the weir site.

The weir will be installed and the field camp opened on or about 6 June. The weir site will be staffed by 2 permanent seasonal Fishery Technician IIIs. Several supplemental personnel from the Soldotna office will be assigned to the weir as needed for weir installation, maintenance, scale sampling, etc. The weir operations for the late run will terminate when the daily count of fish through the weir is less than 1% of the cumulative seasonal count for 3 consecutive days. Historically, this generally occurs in early September. This time period also provides the necessary window for conducting stream surveys of sockeye and Chinook salmon spawning downstream of the weir. Hence, all data collection and winterization of the field camp should be complete by 8 September.

Weir counts by species will be reported by SSB 3230 MHZ radio to the Soldotna office on a daily basis. Sockeye salmon counts will be tabulated and compared with historical migratory timing data to produce inseason estimates of the proportion of each run that has escaped past the weir. These estimates will be used inseason as a management tool to project total escapement by run. The projected estimates will then be used in conjunction with stream survey estimates of sockeye salmon present in the Russian River for making inseason management decisions.

Age, sex, and length data will be collected from samples of sockeye salmon to estimate the age, sex and age-by-sex composition of the escapements from each run. Because the age composition of each run of sockeye salmon may change over time (Carlson and Vincent-Lang 1990; Carlson et al. 1991; Marsh 1992-1998; Nelson et al. 1999; Bethe et al. 2002; Gamblin et al. 2004), proportional weekly sampling will be done to ensure a representative sample. A sample size of 141 (Thompson 1987) is required for each run to meet the objective criteria assuming a scale regeneration rate of 10% (observed 4-6% historically when taking 3 scales per fish, Berkhahn, pers. comm.). The weir technician will sample sockeye salmon for biological data every Friday. A conservative estimate for the size of each run in 2015 was based on the average of the lowest 2 escapements in the last 6 years: 25,595 sockeye salmon for the early run and 35,211 for the late run (Table 1). The sampling fraction is 0.0055 ( $141/25,595$ ) for the early run and 0.004 ( $141/35,211$ ) for the late run. Every Friday and the last day of the early run, 14 July, the number of sockeye salmon that passed through the weir since the previous sample will be multiplied by the appropriate sampling fraction and rounded up to the nearest whole number to obtain the necessary sample size (Table 2). Sampling fractions for 2016 and 2017 will be recalculated prior to each field season after updating Table 1.

Table 2.–Sampling dates and fraction for Russian River weir, 2015.

Sampling date	Use weir count between these times		Sampling fraction length-age-sex
12 Jun	first fish to pass weir	before sampling on 12 Jun	0.0055
19 Jun	after sampling on 12 Jun	before sampling on 19 Jun	0.0055
26 Jun	after sampling on 19 Jun	before sampling on 26 Jun	0.0055
3 Jul	after sampling on 26 Jun	before sampling on 3 Jul	0.0055
10 Jul	after sampling on 3 Jul	before sampling on 10 Jul	0.0055
14 Jul (4 days)	after sampling on 10 Jul	before sampling on 14 Jul	0.0055
17 Jul (3 days)	after sampling on 14 Jul	before sampling on 17 Jul	0.004
24 Jul	after sampling on 17 Jul	before sampling on 24 Jul	0.004
31 Jul	after sampling on 24 Jul	before sampling on 31 Jul	0.004
7 Aug	after sampling on 31 Jul	before sampling on 7 Aug	0.004
14 Aug	after sampling on 7 Aug	before sampling on 14 Aug	0.004
21 Aug	after sampling on 14 Aug	before sampling on 21 Aug	0.004
28 Aug	after sampling on 21 Aug	before sampling on 28 Aug	0.004
4 Sep	after sampling on 28 Aug	before sampling on 4 Sep	0.004

Initial foot surveys of spawning rainbow trout will be conducted in May and early June to index the number of spawning rainbow trout in the lower Russian River. The survey area extends from approximately 100 yards upstream of the power line crossing downstream to the confluence of the Russian River and Kenai River. Surveys will be completed at least once per week beginning after 15 May and extending to 11 June. Typically, the peak index count occurs during the last week in May or the first week in June. These counts serve as a means to review the stock status of spawning rainbow trout in the lower Russian River. Historical records are maintained and may be used to illustrate possible changes in the relative abundance of rainbow trout in the lower Russian River.

Stream surveys may be required inseason to estimate the number of sockeye salmon in the Russian River at several critical periods during the return. If the projected escapement is below the sustainable escapement goal, an estimate of the number of fish actually present in the Russian River would approximate the minimum number of fish expected to pass through the weir if the sport fishery is closed or restricted by Emergency Order. The project leader or the field crew leader will visually survey the river if such additional information is required to formulate a management decision.

The number of late-run sockeye salmon spawning downstream from the Russian River falls will be visually enumerated during stream foot surveys because these fish spawn in the Russian River but do not migrate upstream through the weir. If necessary, 2 surveys will be used to accurately index the spawning escapement in that area of the Russian River. In some years, high water can preclude counts and every effort will be made to obtain an early count to ensure at least a minimum index of the escapement downstream of the falls. The first count will be made on approximately 20 August.

## DATA COLLECTION

All salmonid and nongame species passed through the weir will be counted by species. Daily counts and seasonal totals for all species will be recorded and maintained in the weir data logs as well as the Soldotna office files. Diel time of sockeye salmon passage varies, but is usually

confined to the morning and evening hours. The field camp is equipped with a single sideband radio as well as cellular and satellite phones for transmitting data to Soldotna. Escapement counts of sockeye salmon and other salmonids will be called in at least once daily (0900 and/or 1500) to the project leader.

Early- and late-run sockeye salmon will be enumerated separately. Early-run fish will be counted from 7 June through 14 July. Late-run sockeye salmon will be counted from 15 July until such time that the daily count is less than 1% of the cumulative seasonal count for 3 consecutive days, usually occurring by early September. Both counts are recorded on a daily weir count form (Appendix A1).

Biological sampling of sockeye salmon will occur every Friday and on 14 July. If necessary, additional staff will assist the weir operator to achieve sampling goals. On a given day that fish are to be sampled, the downstream gate on the weir fish trap will be opened and the upstream gate will remain closed. Fish will be allowed to enter the trap and when sufficient numbers have entered, the downstream gate will be closed, capturing the fish. All fish in the trap will be sampled for age, sex, and length. Sockeye salmon will be restrained utilizing a covered measuring cradle to reduce handling stress during scale (age) sampling. One scale will be removed from the preferred area (Clutter and Whitesel 1956) using forceps. Scales will be affixed to appropriately labeled gum cards. Sex will be determined by examining the vent and kype. Length will be recorded to the nearest millimeter from mid eye to tail fork. Detailed biological data collection procedures are summarized for the weir technician in Appendix B1. The number of sockeye salmon sampled that are missing their adipose fin will also be recorded. All data will be recorded on the data form provided (Appendix A2).

Climatological and hydrological data will be collected daily and recorded on standard forms (Appendix A1). These data, collected between 0800 and 0900 hours, include rainfall, minimum and maximum water temperatures, minimum and maximum air temperatures, and water depth at the weir. In previous years, stream velocity had been estimated at Russian River and Rendezvous Creek as both contributing to total stream discharge at the Russian River falls. These stream discharge estimates were calculated using the head rod method of measuring flow. In 2003, staff began revising the historical database for stream velocity and discharge. Using a FP-101 Global Flow Probe and following the prescribed methodology, as outlined in Appendices C1–C2, project staff have measured stream velocities and calculated the discharge for Russian River and nearby Rendezvous Creek. The velocity estimates were recorded for half-inch stream depth intervals that were absent from the database for each stream. The newer equipment and methodology have provided project staff with the means to better define the stage-discharge curves for seasonal flow-rates experienced at the Russian River falls. The Russian River transect is located approximately 75 feet upstream of the weir. The Rendezvous Creek transect is located near the junction of the winter trail and the Russian River falls trail.

The fish pass at Russian River Falls provides a means to allow sockeye salmon and other species access to the spawning grounds during periods of high water. Nelson (1978) concluded that discharges of 400 cubic feet per second (cfs) present a significant barrier to fish migration. The fish pass will be opened by the weir attendant upon direction from the project leader when discharge over the falls (Rendezvous Creek plus Russian River) meets or exceeds 400 cfs (coincides with ~ 19 inch water level measurement at the weir staff gauge). Dates and times of opening and closing the fish pass will be recorded on the Hourly Weir Counts data form (Appendix A1).

At the peak of the late-run instream spawning, approximately 20 August, a foot survey count will be conducted to index the number of fish spawning between Russian River weir and the Kenai River confluence. If timing of the count appears to result in an incorrect assessment, subsequent foot surveys may need to be conducted. The index surveys will be made by the project leader along with the field crew leader or other staff.

## DATA REDUCTION

Daily escapement counts reported to the Soldotna office will be tabulated inseason and compared to historic run timing data to project the final escapement by run. These data and stream survey counts of sockeye salmon will be used to evaluate possible management actions in order to increase the likelihood of meeting the escapement goals.

Daily escapement counts will be added to linked EXCEL spreadsheets that contain historical daily counts (Early run files: 2015\_ER\_Russian\_Workbook; Late run files: 2015\_LR\_Russian\_Workbook). These files will provide graphical and quantitative tools to visually compare the 2015 daily and cumulative escapements with historical values. A final copy of the clean EXCEL files (2015\_ER\_Russian\_Workbook, 2015\_LR\_Russian\_Workbook and LowerRussianSpawners93-15.xls), and the CSV/ASCII scale data files along with the data maps, will be sent to RTS for archiving (Appendix D1).

Data forms containing length and sex data from sampled fish will be returned to the Soldotna office at the end of each week. The forms will be checked by project staff for obvious errors. Scale sample gum cards will accompany each form, and scale impressions from each card will be made on acetate cards. Age interpretations will be made from projections of the acetate scale impressions using a microfiche reader (Clutter and Whitesel 1956). Age determination from the scale impressions will be delineated by the pattern of annuli formed during successive winter months when the circuli of the scales become crowded and finely etched (Clutter and Whitesel 1956). Biological data will be entered on a PC using a comma-delimited file format. The file structure is described in Appendix D1, (2009 Early- and Late-run Russian River Weir Scale Data Map). The electronic data files will be further checked for data entry errors (i.e. checks of impossible dates, location, species, length, age, and length-age relationships).

Final copies of the clean data files, along with the data map, will be stored on the Soldotna LAN server. Following final approval of written reports, the data files and data maps will be archived on the Division of Sport Fish Intranet Docushare collection at <http://docushare.sf.adfg.state.ak.us> (Appendix D1).

## DATA ANALYSIS

The proportion of adult sockeye salmon of age, sex, or age-by-sex category  $g$  migrating through the weir during run  $x$  will be estimated as  $p_{xg}$ :

$$\hat{p}_{xg} = \frac{n_{xg}}{n_x} \quad (1)$$

where:

$n_{xg}$  = the number of sockeye salmon sampled belonging to age, sex, or age-by-sex category  $g$ ,  
and

$n_x$  = the total number of sockeye salmon sampled<sup>1</sup> at the weir during run  $x$ .

The number of salmon of age, sex, or age-by-sex category  $g$  passing through the weir will be estimated for run  $x$  as follows:

$$\hat{N}_{xg} = N_x \hat{p}_{xg} \quad (2)$$

where

$N_x$  = the total number of sockeye salmon enumerated during run  $x$  at the weir.

The variance of  $\hat{N}_{xg}$  will be estimated as follows:

$$V[\hat{N}_{xg}] = N_x^2 V[\hat{p}_{xg}] \quad (3)$$

where

$$V[\hat{p}_{xg}] = \frac{\hat{p}_{xg}(1 - \hat{p}_{xg})}{n_x - 1} \quad (4)$$

Mean length-at-ages and their associated variances will be estimated for each run using standard sample summary statistics (Cochran 1977).

## SCHEDULES AND DELIVERABLES

### Activity List

Operational plan completed.	1 May	Jason Pawluk
Crew leader (FWTIII) on duty.	1 May–15 Sep	Sandee Simons
Weir personnel on duty.	1 Jun–10 Sep	Tom Rhyner
Weir personnel on duty.	1 Jun–10 Sep	Tom Johnson
Weir operational.	5 Jun–8 Sep	
Downstream spawner surveys.	20 Aug–1 Sep	Pawluk/Simons
Scales read.	1 Aug and 31 Oct	Simons/Gist
Annual report submitted.	2015 AMR	Pawluk

### Reports

Results from this project will be reported in the annual Federal Aid Performance Report and an Alaska Department of Fish and Game, Division of Sport Fish Fishery Annual Management Report for the North Kenai Peninsula Management Area.

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<sup>1</sup> When calculating age composition, the number of sockeye salmon sampled would only include those with legible scales.

## RESPONSIBILITIES

### List of Personnel and Duties

Jason Pawluk, Fishery Biologist II, Principal Investigator. Supervise and oversee reporting activities of Fish and Wildlife Technician IIIs. Conduct rainbow and salmon stream surveys. Communicate inseason escapement status with Area Manager. Project support and writing annual reports.

Sandee Simons, Fishery Technician III, Crew Leader. Duties: Relieve weir operators as needed, enumerate salmon, collect biological samples, conduct rainbow and salmon stream surveys, daily contact with crew receiving weir counts and entering into projection sheets and posting online, review and edit electronic data files.

Tom Rhyner, Fishery Technician III, Weir Technician. Duties: Enumerate salmon, collect biological samples, record climatological data, measure and calculate stream flows, operate Russian River Fish Pass, conduct salmon stream surveys.

Tom Johnson, Fishery Technician III, Weir Technician. Duties: Enumerate salmon, collect biological samples, record climatological data, measure and calculate stream flows, operate Russian River Fish Pass, conduct salmon stream surveys.

Pat Hansen, Biometrician III. Duties: Biometric support.

## BUDGET SUMMARY FY16

Line 100: Personnel Services (in thousands). Add 3% increase for FY17–18 budgets.

PCN	Name	Title	Dates	MM	Months	Cost/month	Cost
4165	Pawluk	FB II	07/01/15–09/30/15	3.0	6.0	8.2	53.8
			04/01/16–06/30/16	3.0			
4195	Simons	FT III	07/01/15–09/15/15	2.5	3.5	6.3	24.8
			06/01/16–06/30/16	1.0			
5188	Johnson	FT III	07/01/15–09/10/15	2.3	3.3	5.6	22.8
			06/01/16–06/30/16	1.0			
5219	Rhyner	FT III	07/01/15–09/10/15	2.3	3.3	6.0	25.9
			06/01/16–06/30/16	1.0			
						Total	127.2

Includes premium pay.

Line 200: Travel

Item	Cost
Employee Instate Lodging	0.0
Employee Instate Meals & Incidentals	0.0
Total	0.0

Line 300: Contractual

Item	Cost
Training/Conferences	0.3
Cellular Phone Costs	0.8
Satellite Phone Costs	0.2
SEF Fuel & Operations	4.3
Other Repairs	0.6
Marine	0.5
Aircraft Charters	3.0
Total	9.7

Line 400: Commodities

Item	Cost
Food & Non Food Items	2.6
Clothing & Uniforms	0.5
Firearms & Ammunition	0.3
Other Safety	0.2
Bottled Gas	0.4
Parts & Supplies	1.1
Paint & Small tools	1.0
Other Fuel	0.5
Total	6.6

Line 500: Equipment

Item	Cost
Total	0.0

GRAND TOTAL \$144.1

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## **APPENDIX A: DATA FORMS**

**LOWER RUSSIAN LAKE HOURLY WEIR COUNTS, \_\_\_\_\_, 2015**

	1st Run	2nd Run		2nd Run			
	Adult	Adult	Jack	Total			
Time	Sockeye	Sockeye	Sockeye	Sockeye	Kings	Coho	Remarks
00-06							
06-08							
08-10							
10-12							
12-14							
14-16							
16-18							
18-20							
20-22							
22-24							
<b>TOTALS</b>							
<b>Cumulative</b>							

**H<sub>2</sub>O DEPTH:**

**COMMENTS:**

**\*H<sub>2</sub>O TEMP:**

**\*AIR TEMP:**

**RAIN:**

\* note minimum/maximum temperatures. Weather should be recorded by 9 am every day.

Minimum temps are the morning low for today's date, maximum temps are afternoon high for yesterday's date.

**Fish Pass:** note if open

note times **opened / closed** \_\_\_\_\_

## RUSSIAN RIVER SOCKEYE SALMON ASL SAMPLING FORM

Collector: \_\_\_\_\_

Date: \_\_\_\_\_

Run: \_\_\_\_\_

Card No.	Fish #	Sex	Length	Age
	1	M or F		
	2	M or F		
	3	M or F		
	4	M or F		
	5	M or F		
	6	M or F		
	7	M or F		
	8	M or F		
	9	M or F		
	10	M or F		

Card No.	Fish #	Sex	Length	Age
	1	M or F		
	2	M or F		
	3	M or F		
	4	M or F		
	5	M or F		
	6	M or F		
	7	M or F		
	8	M or F		
	9	M or F		
	10	M or F		

Card No.	Fish #	Sex	Length	Age
	1	M or F		
	2	M or F		
	3	M or F		
	4	M or F		
	5	M or F		
	6	M or F		
	7	M or F		
	8	M or F		
	9	M or F		
	10	M or F		



## **APPENDIX B: PROCEDURES SUMMARY FOR THE RUSSIAN RIVER WEIR TECHNICIAN**

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## Appendix B1.–Procedures summary for the Russian River Weir Technician.

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Daily passage of fish through the weir is more successfully facilitated during the morning and evening hours when the fish seem to be more active and therefore, inclined to migrate through the weir. However, fish may move through the weir at any hour, especially when high numbers are present near the peak of each run. A good indicator that fish are ready to move through the weir is when they are "rattling" the weir pickets by pushing their noses into the spaces between the weir pickets while attempting to swim upstream and causing the pickets to clank and rattle (Marcorelle, pers. comm.). Fish should be allowed to pass through the weir whenever they are actively working to swim through the weir pickets in such a manner.

Adult sockeye salmon, jack sockeye salmon, Chinook salmon, coho salmon, and nongame species will be counted by species. Hourly totals will be recorded in the Weir Count form. At the end of each day, the hourly counts and the fish species totals will be recorded on the Weir Count form. Daily contact with the Soldotna office is maintained via the SSB radio at 0900 each morning. Daily escapement counts and any other pertinent information should be reported at that time. Cellular and satellite phones are provided for use when radio communication is not successful and at other times as directed by the project leader or the field crew leader.

Climatological data will be recorded every day at approximately 0900 on the Weir Count form. Use the Climatological Observations form to summarize by date; air maximum and minimum temperatures (°F), water maximum and minimum temperatures (°F), the water gauge height in inches to nearest one-eighth inch, and rainfall in millimeters. The locations of the various thermometers and gauges will be identified by the field crew leader.

At the beginning of the season, the depth gauge will be calibrated using a line and level. On the north side of the gabion on the cabin side of the river, a green mark has been established at  $21\frac{1}{8}$  inches (top of the wire wrap to bottom of the "V"). Stream velocities for Russian River and Rendezvous Creek will be measured using an Fp-101 Global Flow Probe, following the prescribed methodology in Appendices C1–C2. Measurement techniques will be demonstrated by the project leader and standard measurement sites will be placed in the stream channel. Measurements will be taken at half-inch intervals as water depths change. This information provides data points within half-inch intervals and will be used to establish a stage-discharge curve. Record all data on the Stream Discharge form (Appendix C2) and sum the discharge rates (cfs) for both Rendezvous Creek and the Russian River. This will yield a total discharge over the Russian River Falls. When this total discharge approaches 350 cfs, notify the project leader during a standard 0900 radio contact. Discharge for each stream should be added to the Climatological Observations form as well as to the Weir Count form.

Fish pass operation is typically necessary at discharges of about 400 cfs (water level ~19 inches on staff gauge located at the weir). The weir operator will be instructed on proper fish pass operation by the project leader. Date and time will be recorded on the Daily Log when the fish pass is opened and closed.

A minimum of 141 fish will be sampled proportionally from both early and late runs for age, sex, and age-by-sex composition estimates. The weir technician will sample sockeye salmon for biological data every Friday and 14 July (last day of the early run). Every Friday and 14 July, the number of sockeye that passed through the weir since the previous sample will be multiplied by the appropriate sampling fraction and rounded up to the nearest whole number to obtain the necessary sample size (Table 2).

Record data as indicated on the sampling form provided in Appendices A1–A2. Record your name, location, and date. Prepare a corresponding scale gum card by recording the appropriate data on the yellow side of the card as indicated on the attached example. IMPORTANT: the gum card and the data form must both be numbered identically to ensure that the length and sex data is correctly matched with the corresponding scales.

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-continued-

When fish are to be sampled, the downstream gate on the weir fish trap will be opened and the upstream gate will remain closed. Fish will be allowed to enter the trap and when sufficient numbers have entered, the downstream gate will be closed, capturing the fish. All fish in the trap will be sampled for the appropriate biological data. Fish will be restrained utilizing a measuring cradle that is partially covered with canvas to secure the head of the sampled fish to reduce handling stress.

Remove 3 scales from each fish and affix them to the gum card. Make sure that the "inner surface" of the scale (toward the inside of the fish) is placed against the gum card.

Scales should be clean before they are affixed to the gum card. Place scales on the gum card with the anterior portion of the scale pointing up. Place the 3 scales from a fish in 3 vertical boxes on the gum card. Boxes 1, 11, and 21 correspond to line 1 (fish 1) on the ASL sampling form, boxes 2, 12, and 22 correspond to line 2 (fish 2) on the ASL sampling form, and so on.

Record mid eye to tail fork length to the nearest millimeter and the sex on the form. Check for adipose finclip and note on form.

When sampling is complete, gently place the fish in calm water to allow for recovery. Make sure the fish does not wash downstream onto the weir panels during recovery.



## **APPENDIX C: STREAM VELOCITY MEASUREMENT**

## Appendix C1.–Procedures summary for stream velocity measurement.

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### PROCEDURES SUMMARY FOR STREAM FLOW VELOCITY MEASUREMENT

To turn on flow meter, press right button three times = V <sup>AV</sup>

If MX shows instead of AV, scroll with left button until AV appears. Calibration should always be set at 33.31; this must be reset when batteries are changed by pushing left button.

(Other problems check with FP101-FP 201 Global Flow Probe manual in files on shelf in cabin.)

### TAKING MEASUREMENTS

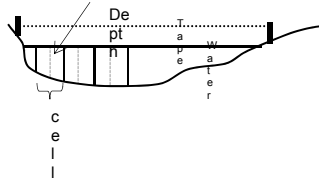
- 1) Make sure propeller turns freely.
- 2) Face arrow inside prop housing downstream when taking velocity.
- 3) Scroll with right button until “V” for velocity appears on screen.
- 4) Push left button to toggle to average (AV) velocities.
- 5) Take a depth measurement and velocity average at waterline, then at 6’ and every 6’ thereafter. Begin at cabin side, end at waterline at far side.
- 6) Note depth and average velocity (bottom number) at each station in write-in-rain book.
- 7) When taking velocity move probe slowly up and down in water column for 40 seconds to obtain average velocity.
- 8) Measure depth, remove probe from water, and push both buttons simultaneously to zero velocities. Now you are ready for velocity measurements.

Shut of probe by putting it into “sleep mode”. Hold both buttons simultaneously for 8 seconds. Push right button two times until sleep appears on screen.

Transfer measurements to worksheet in black notebook and the Stream Discharge form. Send completed form to Soldotna office to be entered into Discharge 03-12.xls workbook.

**\* For Rondy Creek take measurements every 3 feet.**

### Stream Discharge Form



Date \_  
Stream \_  
Staff gauge depth \_  
Collector \_

Cell Boundaries <sup>1</sup>	Location of Depth Measurement <sup>1</sup>	Depth (ft)	Velocity (ft/s)	Cell Width (ft)	Cell Area (ft <sup>2</sup> )	Cell Discharge (ft <sup>3</sup> /s)	Notes
	-	0	0	-	-	-	Waterline <sup>2</sup>
							Variable cell width <sup>3</sup>
3-9	6			6			
9-15	12			6			
15-21	18			6			
21-27	24			6			
27-33	30			6			
33-39	36			6			
39-45	42			6			
45-51	48			6			
51-57	54			6			
57-63	60			6			
63-69	66			6			
69-75	72			6			
75-81	78			6			
81-87	84			6			
87-93	90			6			
93-99	96			6			
99-105	102			6			
105-111	108			6			
111-117	114			6			
117-123	120			6			
123-129	126			6			
129-135	132			6			
135-141	138			6			
							Variable cell width <sup>3</sup>
		0	0	-	-	-	Waterline <sup>2</sup>
Totals:				Strm Width	XS Area	Discharge	

<sup>1</sup> Distance (in feet) from left bank.

<sup>2</sup> For the cell boundary, enter the distance from the left bank to the waterline.

<sup>3</sup> For the first and last cells, the cell boundary is the distance from the waterline to the next (or last) cell.

For the cell depth, the measurement is taken midway in the cell.



## **APPENDIX D: ARCHIVAL DATA MAPS**

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#### Appendix D1.–Data archival maps.

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The following files will be used for the 2015 early- and late-run Russian River escapement counts and weir scale. From 2016 to 2018 the same data archival procedures will be followed. The filenames will change only to reflect the year in which the data were collected.

#### 2015 Early- and Late-run Russian River Escapement Counts

File	Description
2015_ER_Russian_Workbook.xls	Daily and accumulated early-run sockeye salmon counts and projection model for the Russian River weir, 2015. Regression projection model for early-run sockeye at the Russian River weir.
2015_LR_Russian_Workbook.xls	Daily and accumulated late-run salmon counts, including sockeye, coho and Chinook, and projection model for the Russian River weir, 2015. Regression projection model for late-run sockeye at the Russian River weir.
LowerRussianSpawners93-15.xls	Stream survey for lower river spawners, 2015.

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#### 2015 Early- and Late-run Russian River Weir Scale Data Map

File Name	Description
2015 Early-run RRWER15.dta	Scale data for early run (CSV/ASCII file)
2015 Late-run RRWLR15.dta	Scale data for late run (CSV/ASCII file)

All files have the same map:

Column Number	Data
3 - 8	Date (year, month, day)
18 - 20	Location Codes (Russian River drainage)
22 - 23	Site Code (confluence or weir)
28 - 30	Species code
59 - 60	Sampler's initial
62	Sex
64 - 67	Length (MF)
97	Scale card number
99 - 100	Scale location on card
102 -103	Age (Fresh, Marine)
105	Age error (R=regenerated, D=dirty, I=inverted, M=missing, A=reabsorbed, U=unreadable)

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